a semiconductor multi-layer film formed by laminating optical confinement layers and active layers so as to dispose each of said active layers between said optical confinement layers;

a high reflection film coated on a first end of the multi-layer film perpendicular to junction planes of the individual layers in the semiconductor multi-layer film; and

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a low reflection film coated on a second end of the multi-layer film opposite to the first end and comprising Al_2O_3 having a resistivity of $1 \times 10^{12}\ \Omega \bullet m$ or more, wherein the individual layers forming the semiconductor multi-layer film each being made of a semiconductor material simultaneously containing Ga and at least one of In, As, P and Al.

REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-20 are presently active in this case, Claims 1, 9 and 18 amended, and Claim 20 added by way of the present amendment.

In the outstanding Official Action, Claims 1-2, 6-10 and 14-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,067,310 to Hashimoto et al. in view of U.S. Patent No. 6,249,534 to Itoh et al.

First, Applicants wish to thank Examiner Jackson and Supervisory Patent Examiner (SPE) Ip for the personal interview of June 17, 2003, at which time the outstanding issues in the case were discussed. During the interview, amendments and arguments substantially as indicated in this response were discussed. While no agreement was reached, the Examiners recommended positively reciting that the laser facet coating comprises essentially Al_2O_3 in order to clarify that the Al_2O_3 in order to clarify that theAl_2O_3 may include unavoidable impurities. Thus, in order to expedite issuance of a patent in this case, Applicants have

amended Claims 1, 9 and 18 to positively recite a semiconductor multi-layer film, a high reflection film coated on a first end of the multi-layer film perpendicular to the junction planes of the individual layers in the semiconductor multi-layer film, and a low reflection film coated on a second end of the multi-layer film opposite to the first end and comprising essentially Al_2O_3. Claim 1 further recites that the Al_2O_3 has a resistivity of 1 x 10^{12} Ω•m or more, and Claims 9 and 18 recite that the Al_2O_3 has a stoichiometric ratio composition. As discussed in the June 17th interview, the resistivity of 1 x 10^{12} Ω•m or more and the stoichiometric ratio composition are physical properties of the inventive low reflective film, which the present inventors have discovered will reduce catastrophic optical damage (COD) and extend the life of a laser diode.

In contrast, the cited reference to Hashimoto et al. does not disclose a low reflective Al_2O_3 film having either the claimed resistivity range claimed in Claim 1, or the property of a stoichiometric ratio composition as claimed in Claim 9 and 18. Moreover, as discussed in the June 17th personal interview, while Itoh et al discloses a resistivity range of 10^7 Ω•cm or higher, this range is disclosed with respect to GaN and not aluminum oxide AlOx. Specifically, the facet protective layer disclosed in Itoh et al. is made of GaN-based semiconductor material, as mentioned in column 4, lines 38 to 46. In column 6, lines 47-58, Itoh et al. sets forth in connection with the facet protective layer as follows:

> "Alternatively, any other material may also be used so long as the material can establish lattice matching with the nitride semiconductor crystal layers containing the semiconductor laser diode and have transparency to the oscillation wavelength of the laser diode."

Thus, the protective layer is required to establish "lattice matching" with the nitride semiconductor, and from this it is apparent that it is essential for the laser device of Itoh et al. to form the protective layer by a semiconductor layer. Consequently, the protective layer of Itoh et al. basically differs from the counterpart of the present invention which comprises a dielectric film of essentially Al_2O_3 as recited in Claims 1, 9, and 18.

Applicants further note that it is well known to those having ordinary skill in the art that different materials have different resistivity values. Thus, even if Itoh et al. makes mention of optimum resistivity for GaN-based semiconductor layers, the disclosed value is not an optimum resistivity for the facet protective layer of the present invention which comprises an AlO_x film. Applicants submit that the resistivity range disclosed in Itoh cannot be attributed to aluminum oxide. This is also evidenced from the following: The resistivity of the AlO_x film of the present invention is higher than or equal to $1 \times 10^{12}\ \Omega\cdot m$ ($1 \times 10^{14}\ \Omega\cdot cm$), preferably, higher than or equal to $1 \times 10^{12}\ \Omega\cdot m$ ($1 \times 10^{14}\ \Omega\cdot cm$) and at the same time lower than or equal to $1 \times 10^{14}\ \Omega\cdot m$ ($1 \times 10^{16}\ \Omega\cdot cm$). By contrast, the facet protective film of the semiconductor laser device disclosed in Itoh et al. has a resisitivity of $1 \times 10^{5}\ \Omega\cdot cm$ ($1 \times 10^{3}\ \Omega\cdot m$) or more, preferably, $1 \times 10^{9}\ \Omega\cdot cm$ ($1 \times 10^{7}\ \Omega\cdot m$) or more. Thus, the resistivity value is significantly different between the present invention and Itoh et al.

Applicants submit that the resistivity range disclosed in Itoh cannot be attributed to aluminum oxide.

Finally, Applicants note that Claim 20 has been added to the present case in order to vary the scope of protection provided by the claimed invention. Claim 20 includes the limitations of the low reflecting film comprising essentially Al_2O_3 and having a resistivity range of $10^{12}\ \Omega\cdot cm$ or more, and is therefore patentable for the reasons discussed above. In addition, Claim 20 includes the limitation of the individual layers forming said semiconductor multi-layer film being each made of a semiconductor material simultaneously containing Ga and at least one of In, As, P and Al.

In contrast, all of the layers forming the semiconductor laser device of Itoh et al. are GaN-based semiconductor layers. For this reason, it is possible to form a GaN layer as a facet protective layer, as explained in the specification of the present application as prior art etc. In this regard, the individual layers forming the semiconductor laser device of the

present invention of Claim 20 are each made of a semiconductor material simultaneously containing Ga and at least one of In, As, P and Al, as mentioned above. It is impossible to form a GaN as a facet protective layer on such semiconductor layers For example, MOCVD, which is employed to form a GaN layer as a facet protective layer, is carried out at a temperature of as high as 1000°C, the crystals are destroyed by intense heat. This is evident to those having ordinary skill in the art. In consequence, the application of the teachings of Itoh et al. to the present invention per se is not possible.

For the reasons stated above, independent Claims 1, 9 and 18, as amended, patentably define over the cited references. As the remaining pending claims depend from Claims 1, 9, and 18, these dependent claims also patentably define over the cited references.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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IN THE CLAIMS

Please amend the claims as follows:

1. (Amended) A semiconductor laser device comprising

a semiconductor multi-layer film formed by laminating optical confinement layers and active layers so as to dispose each of said active layers between said optical confinement layers[, wherein one of the opposite ends];

a high reflection film coated on a first end of the multi-layer film perpendicular to [the] junction planes of the individual layers in said semiconductor multi-layer film; and [is coated with]

a low reflection film [and the other of said ends is coated with a high reflection film, wherein said low reflection film contains a film comprised of at least] coated on a second end of the multi-layer film opposite to the first end and comprising essentially Al_2O_3 having a resistivity of 1×10^{12} Ω·m or more.

8. (Amended) A semiconductor laser device comprising:

a semiconductor multi-layer film formed by laminating optical confinement layers and active layers so as to dispose each of said active layers between said optical confinement layers[, wherein one of the opposite ends];

a high reflection film coated on a first end of the multi-layer film perpendicular to [the] junction planes of the individual layers in said semiconductor multi-layer film; and [is coated with]

a low reflection film [and the other of said ends is coated with a high reflection film, wherein said low reflection film contains a film comprised of] <u>coated on a second end of the multilayer film opposite to the first end and comprising essentially</u> Al_2O_3 having a stoichiometric ratio composition.

18. (Amended) A semiconductor laser device comprising:

a semiconductor multi-layer film comprising at least one confinement layer and at least on active layer;

a high reflection film substantially perpendicular to the semiconductor multi-layer film; and

a low reflection film substantially perpendicular to the semiconductor multi-layer film, wherein the low reflection film comprises <u>essentially</u> Al_2O_3 having a stoichiometric ratio composition.

Claim 20 (New).